Fading characteristics of wideband trans-ionospheric UHF signals

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Extended abstract

Ultra-High Frequency (UHF) equatorial trans-ionospheric signals are known to experience both flat-fading (FF) and frequency-selective fading (FSF), but the relative probability of occurrence is poorly understood. This paper will present the analysis of around 600 hours of MUOS-3 downlink (360 MHz to 380 MHz) signal magnitude data collected between 20 UT and 02 UT at Cape Verde Atmospheric Observatory (16.8°N, 24.8°W geographic; 10° N dip latitude).

The data were categorised automatically into FF, FSF or no fading (NF) by correlating the first-differential of the time series at two frequencies. The unnormalized correlation is positive when the fading is flat, negative when it is frequency-selective and zero when there is no fading. A correlation guard band was imposed to mitigate spurious categorisation.

FSF events were found to last for far shorter periods than the flat fading. They were also far less common as can be seen in Figure 1 which describes the relative probability of FF, FSF and NF for different S4, when the frequency separation was 15 MHz. In order to realise this analysis, the S4 were calculated over the unusually short period of 7.5 s.

The paper will describe these and other analyses over bandwidths from 5 to 15 MHz with the aim of helping UHF satellite communication designers realize transmission waveforms best optimized to the channel.

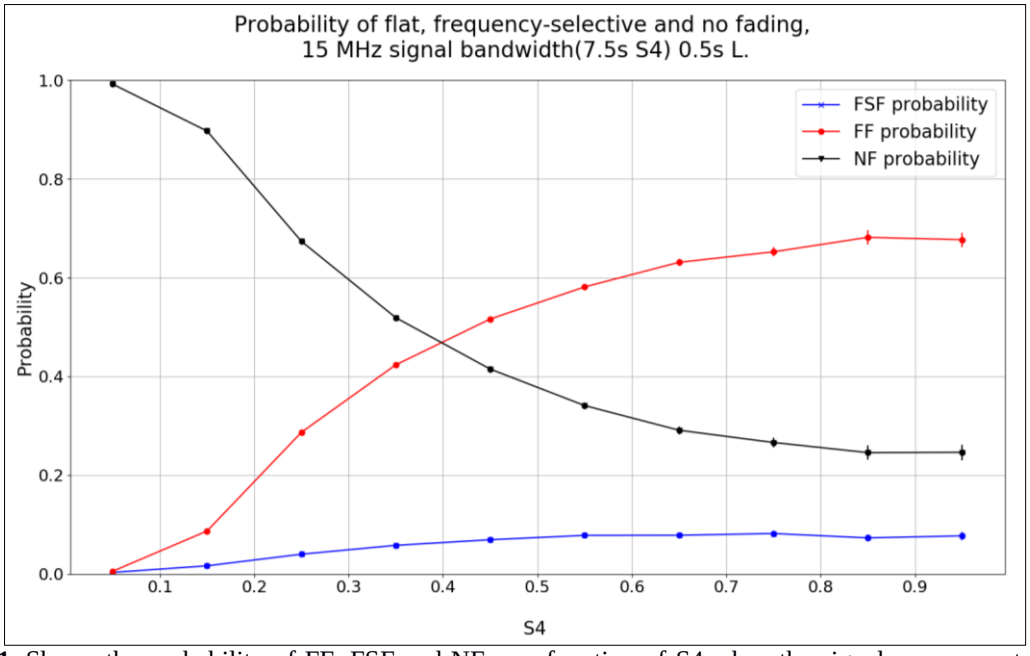

Figure 1. Shows the probability of FF, FSF and NF as a function of S4 when the signals are separated by 15 MHz. The correlation length for categorisation is 0.5 s and S4 is estimated over 7.5 s.